IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Bhabendra Pradhan

SERIAL NO.: 10/628,842 GROUP ART UNIT: 1754

FILED: July 28, 2003 EXAMINER: Lish, Peter J.

FOR: "Improved Catalyst and Process to Produce Nanocarbon Materials in High Yield and at High Selectivity at Reduced Reaction Temperatures"

ATTORNEY DOCKET NO.: A03092US (15630.141)

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES
BRIEF OF APPELLANT

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sirs:

On January 10, 2006, the examiner finally rejected claims 1-10 and 20 of the above-referenced patent application. A Notice of Appeal was filed on June 1, 2006, and was received by the Patent Office on June 21, 2006. This brief, required by 37 C.F.R. § 1.192(a), is due on January 21, 2007 (see 37 C.F.R. § 1.8(a)(2) and MPEP § 512 (Eighth Edition First Revision (E8R1) 02/2003)); it is in the form required by 37 C.F.R. § 41.37©).

(1) REAL PARTY IN INTEREST:

The real party in interest is the assignee of record, Columbian Chemicals, Inc.

(2) RELATED APPEALS AND INTERFERENCES:

There are no related appeals or interferences.

(3) STATUS OF CLAIMS:

Claims 1-10 and 20 are rejected while claims 11-19 were withdrawn from consideration.

Claims 1, 4-6 and 20 were rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Smalley et al. (US 6,761,870).

Claims 1-2, 4-10 and 20 were rejected under 35 U.S.C. § 102(e) as being anticipated by, or in the alternative, under 35 U.S.C. 103(a) as obvious over Huang et al. (US 2004/0005269 A1).

The rejection of claims 1-10 and 20 is being appealed.

(4) STATUS OF AMENDMENTS:

No amendments after final rejection have been filed.

(5) SUMMARY OF INVENTION:

As required by 37 C.F.R. § 41.37(c)(1)(v), Applicant has read an appealed claim on the specification and drawings. This claim follows:

1. A process for producing nanocarbon materials, (pg. 11, lines 8-9) comprising the following steps:

a. providing an unsupported catalyst (pg.3, line 12) with a particle size of ≤=10 nm (pg. 11, line10) and a surface area greater than 50 m2/g (pg. 11, line 11);

b. reacting carbonaceous feedstocks (pg. 11, line 31) in the presence of the catalyst over a given period of time (pg. 11, line 13) to produce carbon nanofibers (pg. 11, line 13) with over 99% purity (pg. 11, line 14) and a morphological selectivity greater than 95% (pg. 9, line 17) in yields ≥=140g carbon/g catalyst (pg. 9, lines 18-19)) with higher reactivity (pg. 11, line 15).

(6) ISSUES:

Are claims 1, 4-6 and 20 anticipated under 35 U.S.C. § 102(e) or, in the alternative obvious under 35 U.S.C. § 103(a) over Smalley et al. (US 6,761,870)?

Are claims 1-2, 4-10 and 20 anticipated under 35 U.S.C. § 102(e) or, in the alternative obvious under 35 U.S.C. § 103(a) over Huang et al. (US 2004/0005269 A1)?

(7) GROUPING OF THE CLAIMS:

The rejected claims do not stand or fall together. Based on the references cited and arguments made by the Examiner, the claims are grouped together in particular combinations in part (8) for convenience. Applicant reserves the right to regroup the claims or to argue the patentability of each claim individually should new references be cited or new arguments or rejections be made.

(8) ARGUMENT:

The Rejection of claims 1, 4-6 and 20 as anticipated by, or in the alternative obvious over Smalley et al. (US 6,761,870)

In the rejection of claims 1, 4-6 and 20 in view of Smalley et al, the Examiner stated that the Smalley patent taught a method for the selective growth of single-walled carbon nanotubes (SWNTs); and that the purity of the SWNT product is greater than 99%. In reading the Smalley patent, at col. 4, lines 60-67, the purity stated is "substantially pure (99%)," which is not greater than 99% as stated by the Examiner.

The present invention is capable of producing materials with a selectivity of greater than 95%. The nature of the process favors very high selectivity rates that will approach 100%, and 100% selectivity is theoretically possible. More commonly, selectivity will approximate 98%, 99%, or 99.9%. Traditional production methods are generally limited to selectivity values of 90%.

Additionally, the Examiner admits that Smalley does not teach the yield of the process, but surmises that "it meet the claimed range because of the high purity and selectivity of the product as well as the extremely small size of the catalyst. The Examiner, unable to find the elements of the claimed invention, resorts to using the inherency argument. Applicant would disagree with the Examiner that if the Examiner cannot determine whether or not the reference possesses such qualities as claimed, the burden shifts to the applicant. The Smalley reference is in fact silent on the claimed qualities of a morphological selectivity greater than 95% in yields $\geq$=140g carbon/g catalyst with higher reactivity. However, if the burden does shift, then applicant has met that burden by offering evidence within the application; and the Smalley reference does not appear to claim a product having those qualities, but to provide "a method and apparatus for the efficient, industrial scale production of single-wall carbon nanotubes (SWNTs) ...which is substantially free of solid contaminants or by-products." (Column 3, lines 51-55)

Therefore, independent claim 1 is not anticipated by or obvious over the Smalley patent cited by the Examiner. Since claims 4-6 and 20 are dependent from allowable claim 1, these claims are likewise patentable over Smalley.

The Rejection of Claims 1-2, 4-10 and 20 anticipated under 35 U.S.C. § 102(e) or, in the alternative obvious under 35 U.S.C. § 103(a) over Huang et al. (US 2004/0005269 A1)

Next, the Examiner rejected claims 1-2, 4-10 and 20 anticipated under 35 U.S.C. § 102(e) or, in the alternative obvious under 35 U.S.C. § 103(a) over Huang et al. (US 2004/0005269 A1). Again, using the inherency argument, the Examiner admits that the yield, like in Smalley, is not taught in the Huang et al reference. He states: "However, it is expected that it meet the claimed range because of the productivity of the catalyst." Huang et al does not teach or describe the purity and yield of the claimed process. Based on literature and limited data generated at applicant's company, a similar process utilizing a supported catalyst would be limited to a maximum purity of approximately 40% and a maximum yield of approximately 30%. These values are typical for a process using a supported catalyst. In the present invention, the catalysts are not supported and the referenced surface areas describe the catalytically active material, not diminished by the presence of an underlying support.

In the present invention, selectivity is defined as the "fraction of the carbonaceous product possessing the intended morphology (orientation of graphene layers)". Applicant's conventional use of the term refers to the bulk fraction of materials produced, not the uniformity of internal microstructure within a given nanotube. While applicant cannot speak for materials produced in the Huang et al process, the materials produced using the present invention do not contain any amorphous carbon film. Applicant's company has extensive experience in the characterization and analysis of nano-carbon materials. Its analytical capabilities include x-ray diffraction and scanning transmission electron microscopes. These materials have been extensively characterized and no such amorphous materials have been found. This if further reflected in the high selectivity of the process of the present invention.

In general, the present invention describes the process of producing carbon nano-fiber materials using unsupported catalysts. No other process is currently known which can achieve the high degree of yield, purity, and selectivity. No unsupported catalyst materials exist in the size and surface area range as those of the present invention. It appears that the obviousness rejections are based in the confusion between the present invention and those in Smalley and Huang et al.

Therefore, claim 1 is not anticipated by nor obvious over the patent to Huang et al. Since claims 2, 4, and 20 are dependent from allowable claim1, these dependent claims are likewise patentable over Huang et al. Also, independent claim 7, which claims the qualities of the resultant product not found in Huang et al, claim 1 is likewise not anticipated nor rendered obvious over the Huang et al patent; and dependent claims 8 through 10, depending off allowable claim 7, are likewise patentable over Huang et al.

CONCLUSION:

For the foregoing reasons, applicant respectfully submits that all claims remaining in the application are allowable. A Notice of Allowance is hereby respectfully requested.

TELEPHONE CONFERENCE INVITATION:

Should the Examiner or any member of the Board feel that a telephone conference would advance the prosecution of this application, he is encouraged to contact the undersigned at the telephone number listed below.

PETITION FOR EXTENSION OF TIME:

Applicant hereby petitions the Commissioner under 37 C.F.R. § 1.136 for any extension of time necessary to render this Appeal Brief timely filed, and asks that the fee for any such extension be charged to Deposit Account No. 50-0694.

FEES:

Please charge the $500 fee required by 37 C.F.R. § 1.192(a) and § 1.17(f) to Deposit Account No. 50-0694. Please charge the $2,160 fee for the fifth extension of time to Deposit Account No. 50-0694. Please charge any additional fees due or credit any overpayment to Deposit Account No. 50-0694.

Respectfully submitted,

/gcs/

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(9) APPENDIX:

CLAIMS ON APPEAL:

1. A process for producing nanocarbon materials, comprising the following steps:

a. providing an unsupported catalyst with a particle size of ≤=10 nm and a surface area greater than 50 m2/g;

b. reacting carbonaceous feedstocks in the presence of the catalyst over a given period of time to produce carbon nanofibers with over 99% purity and a morphological selectivity greater than 95% in yields ≥=140g carbon/g catalyst with higher reactivity.

2. The process in claim 1, wherein the catalyst is a metal oxide catalyst selected from the metals including iron, nickel, cobalt, lanthanum, gold, silver, molybdenum, iron-nickel, iron-copper and their alloys.

3. The process in claim 1, wherein the catalyst is prepared to specific parameters (size distribution, composition and crystallinity)specified and via a flame synthesis process.

4. The catalyst in claim 1, wherein the catalyst possesses a single crystal morphology.

5. The process in claim 1, wherein the yield of carbon nanomaterial resulted in ≥=140gcarbon per g/catalyst.

6. The process in claim 1, wherein the morphology of the carbon micro structure can be selectively controlled to achieve various desired orientations in selectivities of ≥=90%.

7. A process for producing nanocarbon materials, comprising the following steps:

a. providing an unsupported metal oxide catalyst with a particle size of about ≤=10 nm and a surface area greater than 50 m2/g;

b. reacting carbonaceous feedstocks in the presence of the catalyst over a given period of time to produce carbon nanofibers with over 99% purity and a morphological selectivity between 95% and 100% with yield ≥=140g carbon/g catalyst.

8. The process in claim 7, wherein the reaction took place at a temperature not exceeding 550 C.

9. The process in claim 7, wherein the purity of carbon nanofibers was ≥=99% after 8 hours reaction time.

10. The process in claim 7, wherein the metal oxide catalyst is selected from a group

of metals including iron, nickel, cobalt, lanthanum, gold, silver, molybdenum, iron-nickel, iron-copper and their alloys.

20. The process in claim 1, wherein the nanofibers possess a morphological selectivity between 95% and 100% in yields ≥=140g carbon/g catalyst with higher reactivity.

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